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ABSTRACT

This study explored the possibility of linking the Luna (1999) student flow matrix model with institutional planning at a comprehensive state institution, investigating how student flow environments were associated with student characteristics such as race, gender, citizenship, class level, entry type, and cumulative grade point average. The study was based on data from 170,160 student records for the period 1986-98. Each student's identification number, degree status, and school/college from each fall semester was matched with the same information from the following fall semester to determine whether the student had stayed within the same school, transferred to another school within the university, graduated, or withdrew from the university. Retention rates were compared for various student characteristics. Data analysis indicated that the matrix model, in combination with retention and withdrawal rates underlying it, helped identify and describe retention and withdrawal patterns within the institution. The model showed how student retention and withdrawal patterns were or were not associated with student characteristics. Breaking the data out by subgroups helped focus attention on the interaction between university characteristics and environments. Gender did not relate to retention overall. All background characteristics significantly associated with type of retention except gender and citizenship. (Contains 33 references.) (SM)

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Linking Student Retention Model with Institutional Planning: The Benefits and Limitations of a Student Matrix Model

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Linking Student Retention Model with Institutional Planning: The Benefits and Limitations of a Student Matrix Model

ABSTRACT

While the higher education literature provides an exhaustive range of theory about the reasons for students leaving, as well as proposals for positive intervention, it remains critical for university administrators to understand the unique combination of factors contributing to student attrition at their institutions. The student flow matrix model developed by Luna provides a mechanism for the analysis of the multiple aspects of trends in undergraduate retention for subgroups of students within the university. This study develops the model for a mid-sized public comprehensive institution and explores how the resulting information can be used to inform university planning and decision-making.

Linking Student Retention Model with Institutional Planning:
The Benefits and Limitations of a Student Matrix Model

Since a high rate of student retention is often considered to be a measure of an institution's performance, the reasons behind and the process of student attrition has been of special interest to administrators and institutional researchers as well as scholars in the higher education field during the last few decades (Summerskill, 1962; Spady, 1970; Tinto, 1975, 1993; Bean, 1980, 1983; Pascarella and Terenzini, 1977; Stage, 1989; Dey and Astin, 1993). As a result, numerous studies have been undertaken on the topic of college student attrition since early 1960. Early studies focused heavily on identifying the psychological differences between leavers and persisters (Heilbrun, 1965; Rose and Elton, 1966). In the 1970s and 1980s, various theoretical perspectives--sociological (Spady, 1970), social anthropological (Tinto, 1975, 1987), economic (Iwai and Churchill, 1982), and organizational (psychology) (Bean, 1983)--have been employed to explain the causes of student attrition.

While the higher education literature provides an exhaustive range of theory about the reasons for students leaving as well as proposals for positive intervention, it remains critical for university administrators to understand the unique combination of factors contributing to student attrition at their institutions. The student flow matrix model developed by Luna (1999) provides a mechanism for the analysis of the multiple aspects of trends in undergraduate retention for subgroups of students within the university. Administrators may then use the insights gained from these analyses to guide enrollment management and institutional planning, such as decisions on implementing new tuition or admissions policies, or new interventions intended to enhance student success.

Three primary purposes guide this study. The first is to explore the possibility of linking a retention model with institutional planning. We hope to assess the usability of the Luna's matrix model at this institution. The second purpose of this study is to

examine how student flow environments are associated with various characteristics of students, such as race, gender, class level, entry type, and cumulative GPA. The third purpose is to interpret and present the findings in a way that would lead to action.

Background

Since its foundation in 1957, the institution of this study, a comprehensive public university, has grown to almost 15,000 students, including almost 12,000 undergraduates. The first report on the success of undergraduate students, "How Many Succeed?" was published in 1972 and examined the success rates of students based on first-term course-load and GPA, gender, and type of entry for students entering in 1964–'66. Methods and variables studied since then have varied, but in general, these studies of new student cohorts continue to provide the university with information to guide decision-making and improve programs and services. However, as a university located in large metropolitan region, this school has high proportions of transfer, part-time, non-traditional, first-generation and commuting students. These students often have significant external obligations, so that their enrollment decisions may entail many more factors than those of the "traditional" full-time residential student. In order to understand the enrollment flows of the entire undergraduate student population, alternatives to the traditional cohort studies of retention are required.

In 1998, this university participated in the pilot of an alternative study method which measured the one-year student retention for all undergraduates. The method was developed and piloted at Indiana University-Purdue University at Indianapolis. This study was intended to provide a "framework for comparing Fall to Fall enrollment among all degree-seeking undergraduate students across a variety of universities" (Borden, 1998). The method controls for differences in student body profiles, and thus also permits comparisons of subgroups of students within the institution. The initial study was limited to comparing retention from one fall term to the next. In 1999, this university's president

directed the institutional research office to undertake a large-scale longitudinal retention study using the matrix model developed by Luna (1999).

Literature Review

This study is methodologically based on Luna's (1999) student flow matrix model. Luna (1999) presents a matrix model as a planning tool to identify retention and withdrawal patterns and to understand student flow characteristics within an institution. In his study, student flow is defined as the sum of graduation, internal retention, external retention, and withdrawal. The student flow matrix graphically depicts various enrollment environments by measuring a change - either increase or decrease - from year to year in each of the three retention/attrition rates; internal retention, external retention, and withdrawal rates. The matrix model is designed to provide administrators, deans or department heads with specific information for use in further study.

Personal Factors affecting persistence/withdrawal behavior

Previous studies have shown that students' enrollment decisions result from complex interactions between the student, the institution, and the environment, and that a variety of psychological, sociological, economic, and environmental factors are involved in the attrition process (Tinto, 1975, 1993; Bean, 1990).

Personal characteristics that influence persistence/withdrawal behavior include age, gender, race, socioeconomic status, motivation, personality, and enrollment status. While Tinto's and Bean's theoretical models consider the demographic variables as having indirect effects on attrition or correlates rather than as determinants of attrition (Tinto, 1993; Bean, 1980), sociological studies of social or educational attainment tend to emphasize the significant role of certain demographic variables (e.g., such as gender, racial/ethnicity, and socioeconomic status), in the student attrition process (Anderson, 1987).

Empirical studies evidenced a considerable difference in the pattern of influence by gender and racial/ethnic groups (Pascarella & Terenzini, 1979; Stoecker, Pascarella & Wolfle, 1988; Cash & Bissel, 1985). Overall, male and/or minority students were more likely to leave college (Brower, 1992; DesJardins, Ahlburg & McCall, 1997). Grade point average (GPA) has been documented as one of the key variables in the withdrawal process (Cabrera, Nora, & Castaneda, 1992; Ronco, 1996; Bean, 1983; Aitken, 1982; Edwards & Waters, 1983). Using survival analysis with 1,635 first-time college students, Ronco (1996) found that students with low GPA were more likely to drop out or transfer to a two-year institution.

Several other variables of interest to this study have been shown to be associated with college student withdrawal. As a reflection of relative time in college, class level is one such variable. The period of highest risk of leaving school occurs in the second, third, and fourth semesters regardless of gender and racial/ethnic group (Han & Ganges, 1995). Upper class students are less likely to drop out because the benefits associated with staying in college become more attainable as become closer to the goal of the degree. Part-time enrollees are also more likely to drop out (Bean & Metzner, 1985).

Type of entry is another variable of interest. Student attrition research has had mixed results in attempting to determine whether community college transfer students withdraw at a higher rate when compared with their peers who enter directly into four-year institutions. Several studies have documented a persistent disadvantage to community college transfer students in succeeding in the four-year institutions of higher education and in pursuing the baccalaureate degree (Townsend, 1995; Dougherty, 1992). However, using data from a more recent national study, High School and Beyond, Lee et al. (1993) reported quite a different finding: "it is quite simple to summarize the effect of community college attendance on persistence - there is none (p.104)."

Method

Data

This study investigated the student flow patterns of undergraduate students, first-time freshmen, and new transfers, by school, at a comprehensive, state-supported institution over a 13-year period from fall 1986 to fall 1998. One of the colleges was further divided into three discipline-based sub-groups for additional analysis. The study was based on data from 170,160 student records during the 13-year period. Each student's identification number, degree status, and school/college from each fall semester was matched with the same information from the following fall semester to determine whether the student stayed within the same school, transferred to other school within the university, graduated, or withdrew from the university. Only degree-seeking students were selected for analysis.

Procedures and data analysis

The primary methods used in the study follow the methodology described by Luna (1999). First, internal retention rates, external retention rates, and withdrawal rates were calculated for the subgroups in each school. Internal retention rates are calculated by taking the percentage of students enrolled within a particular school for a given fall semester who were still enrolled in the same school the following fall. The external retention rate is calculated for those students who transferred to another school within the university. The withdrawal rate is the percentage of students who did not return to the institution the following fall (and had not graduated). The percent of students who graduated prior to the second fall is also calculated, but because the model is concerned with the retention and attrition patterns of students who have not yet received degrees, they are not incorporated into the matrix.

Second, a measurement as to whether each rate increased or decreased from year to year determined eight possible student flow environments within a school. The

sustaining environment is defined as one where both the internal and external retention rates have increased, while the withdrawal rate has decreased, indicating that students are remaining at the institution, either in the same or another school. In a *persisting* environment, internal retention increased, while both external retention and withdrawals decreased, indicating that students are choosing to continue in this school. In a *departing* environment, internal and external retention has declined, while withdrawals have increased. A more complicated scenario is found in the *digressive* environment, in which the internal rate has decreased, while the external retention rate and the withdrawal rate have increased. Students are choosing to leave a particular school either to transfer internally or leave the institution. In a *decisive* environment, students appear to either be happy with the current school or choose to withdraw so that the internal retention and withdrawal rates both increase, while external retention rate decreases. The *migrating* environment is defined as one where both the internal retention and withdrawal rates have decreased, while the external retention rate has increased. In a *modulating* environment, all three rates have increased, whereas in an *attenuating* environment all three rates have declined.

Third, the frequency of the occurrences of environments over time suggests a retention/withdrawal pattern of individual schools as well as the university as a whole.

Finally, in order to investigate how the background characteristics of undergraduate and graduate students are associated with the type of retention, the retention rates were compared for the subgroups of the key variables identified in the literature review, such as gender, race, citizenship, student level, student entry type, enrollment status, residency status, and cumulative GPA. The Chi-square analysis was used to test the relationship of the type of retention and students' characteristics, except for the GPA variable for which the one-way ANOVA was employed.

Results

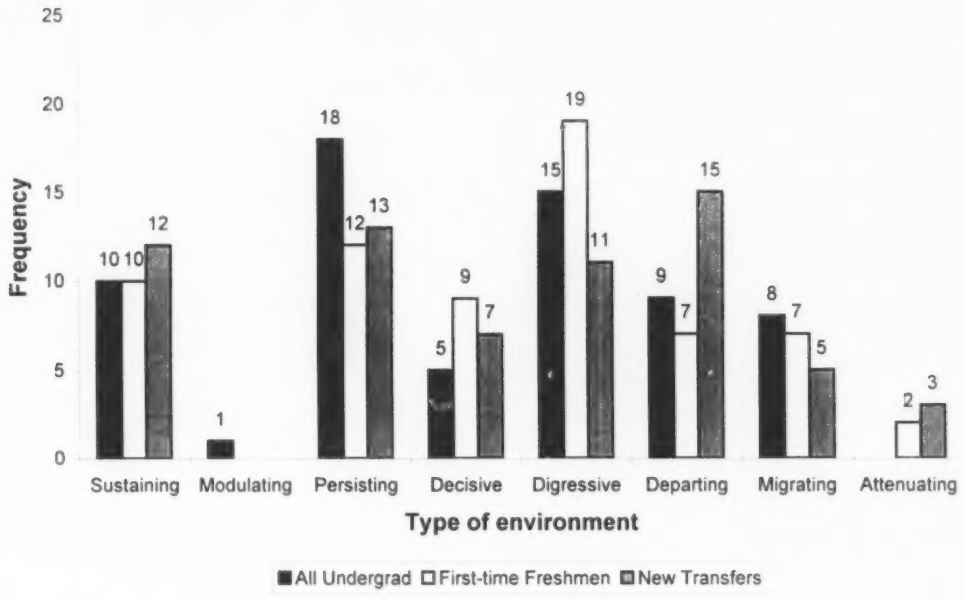
Overall Retention/Withdrawal Rates

Across the schools and over time, the internal retention rates for undergraduate students ranged from a high of 65% to a low of 45%, with the average being about 57%. External retention rates averaged about 7.5%, suggesting that there may be less movement between schools than is commonly assumed at this institution. Withdrawal rates varied greatly, from a high of 31% to a low of 15%, with the average of 22%. The internal rate for first-year students ranged from 72% to 55%, with an average of 64%. Interestingly, the low and high were in the same school, confirming the importance of tracking changes in retention over time. There was significant variation in the retention and withdrawal rates across the schools as well. Most schools seemed to move up and down, though not in the same patterns. Only one school showed increases in retention in eight of the eleven years in the comparison. Most decreased as often as they increased.

Student Flow Patterns

Presenting these results within the matrix model for all undergraduate students (see Figure 1), the persisting environment occurred most frequently, while the next most common was the digressive environment. However, when we looked at the sub-groups of all undergraduate students, such as first-time freshmen and new transfers, we found that retention-related school environments were considerably different among the sub-groups and the undergraduate population as a whole. As with the retention rates, the environments tended to vary widely across the schools and across time. For the first-time freshmen, the situation was reversed with the digressive environment occurring most frequently among all schools, followed by the persisting environment. This finding is consistent with the first-year attrition that is typically observed in institutional cohort tracking studies.

Figure 1.
Frequencies of School Environments for All Undergraduate, First-time Freshmen, and New Transfer Students: 1986-1997



Different from the first-time freshmen group, the undergraduate students who first transferred to the university (new transfers) experienced the departing environment most frequently, followed by the persisting environment. The high occurrence of the departing environment is confirmed when we look at the average withdrawal rate for new transfer students. As shown in Table 1, at over 33%, it far exceeds the 22% average rate of all undergraduates combined, and the 26% average rate of first-year students. This appears to support the claim – at least for this institution - that transfer students are more at risk of leaving compared with students who entered as first-time students directly into a four-year institution.

Table 1
Average Retention/Withdrawal Rates for All Undergraduate, First-time Freshmen, and New Transfer Students between 1986 and 1997

	Internal Retention Rates			External Retention Rates			Withdrawal Rates		
Year	AU*	FTF	NT	AU*	FTF	NT	AU*	FTF	NT
1986	56.4	65.0	55.6	8.5	10.2	9.1	25.1	22.5	33.5
1987	55.3	63.6	52.7	7.5	8.2	12.6	23.4	26.7	34.4
1988	56.6	64.5	56.8	6.9	8.6	7.6	21.9	25.4	31.4
1989	58.1	63.3	62.0	7.9	10.5	8.3	20.0	24.4	28.5
1990	57.9	63.6	58.7	7.9	9.9	8.1	20.0	24.1	32.8
1991	56.2	64.0	55.2	8.7	11.9	10.9	21.5	24.1	33.6
1992	60.0	66.0	60.4	3.8	4.6	5.0	23.2	29.4	34.3
1993	58.4	65.0	62.8	7.2	6.9	6.6	21.9	28.1	30.2
1994	58.0	65.9	57.4	6.5	6.3	7.4	22.8	27.8	35.1
1995	56.5	65.4	54.8	8.3	8.4	9.9	23.4	26.2	35.3
1996	56.8	62.9	55.3	8.0	10.8	8.9	21.5	26.3	35.8
1997	56.8	61.6	54.3	8.6	10.9	9.7	21.9	27.4	35.9
Mean	57.2	64.2	57.2	7.5	8.9	8.7	22.2	26.0	33.4

Note: AU indicates All Undergraduates; FTF First-time Freshmen; and NT New Transfers.

* The averages of all undergraduates (AU) are also the university averages.

Student Flow Patterns Within a School

Observing student flow patterns within each school can also help us to identify patterns of enrollment behavior and future trends within the school. As shown in Table 2, the environments experienced by undergraduate students in each school differs markedly from each other, and from the environments that are described by aggregating the data at the institutional level. For example, both School 1 and School 3 experienced the persisting environment most frequently. In contrast, School 4 experienced the digressive environment and School 5 experienced the departing environment at the same frequency.

Table 2
Student Flow Matrix Model: Placement Results for All Undergraduate Students

School	1986	1987	1988	1989	1990	1991
School 1	n/a	Persisting	Persisting	Departing	Sustaining	Digressive
School 2	n/a	Digressive	Sustaining	Persisting	Sustaining	Modulating
School 3	n/a	Persisting	Persisting	Sustaining	Persisting	Digressive
School 4	n/a	Persisting	Sustaining	Digressive	Migrating	Digressive
School 5	n/a	Persisting	Departing	Sustaining	Departing	Departing
School 6	n/a	Digressive	Sustaining	Migrating	Digressive	Digressive

School	1992	1993	1994	1995	1996	1997
School 1	Persisting	Migrating	Departing	Decisive	Persisting	Digressive
School 2	Decisive	Sustaining	Departing	Sustaining	Persisting	Digressive
School 3	Persisting	Migrating	Decisive	Digressive	Departing	Sustaining
School 4	Decisive	Migrating	Persisting	Digressive	Persisting	Digressive
School 5	Departing	Digressive	Persisting	Digressive	Migrating	Persisting
School 6	Decisive	Migrating	Departing	Migrating	Persisting	Persisting

Combining Student Flow Patterns and Retention/Withdrawal Rates

Since the matrix environments describe changes in the direction of the retention and withdrawal rates, they are relative rather than absolute measures. For this reason, they are most helpful in identifying patterns of activity over time and for comparing those patterns across groups. In most cases it will be equally important to examine the flows of the retention and withdrawal rates that lie behind the environments and look for patterns in them as well.

For example, when looking at Table 2, one can see that school 1 experiences frequent increases in internal retention (the persisting, sustaining and decisive environments) while it also experiences frequent decreases in retention (departing, digressive, and migrating environments). Examination of the internal retention rates in Table 3 shows that school 1 has the lowest average retention rate for the period and is consistently below the university average, (although there is no pattern that would clearly indicate a trend in one direction or another.) On the other hand, school 3 experienced the

same number of persisting environments – but all in the first six years of the study as shown in Table 2. In the last five years, it has experienced every environment but persisting, and a review of its retention rates indicates that although it has been consistently higher than the university average, and has the highest average internal retention rate, it may be sliding into a downward trend (see Table 3).

Table 3
Internal Retention Rates for All Undergraduate Students by School: 1986-1997

Year	School 1	School 2	School 3	School 4	School 5	School 6	Average*
1986	53.0	56.6	57.0	59.4	55.1	57.4	**56.4**
1987	55.7	44.6	58.2	60.0	59.6	53.6	**55.3**
1988	56.2	48.7	59.9	61.0	58.1	55.9	**56.6**
1989	54.4	54.9	61.9	58.6	65.1	53.7	**58.1**
1990	55.7	55.7	62.8	58.3	61.5	53.3	**57.9**
1991	53.9	55.9	56.9	57.9	60.7	51.9	**56.2**
1992	58.2	60.7	64.5	60.5	57.4	58.4	**60.0**
1993	56.5	61.3	60.7	58.4	57.4	55.9	**58.4**
1994	54.4	57.6	61.1	59.1	61.7	54.0	**58.0**
1995	54.5	61.2	59.1	56.7	56.9	50.8	**56.5**
1996	55.5	64.0	54.9	62.2	52.2	52.2	**56.8**
1997	54.1	60.7	57.6	57.5	55.9	54.9	**56.8**
School Mean**	55.2	56.8	59.5	59.1	58.5	54.3	**57.2**
Range							
Max	58.2	64.0	64.5	62.2	65.1	58.4	60.0
Min	53.0	44.6	54.9	56.7	52.2	50.8	55.3

* The average rate of the six schools on the table.

** Mean rates between 1986 and 1997.

School 5's frequency of departing clearly signals a real trend for this school that is borne out by looking at the trend of the withdrawal rates. But while school 4 experiences decreases in internal retention in about half of its environments (digressive, migrating), it also has one of the highest average retention rates and is always above the university average for the year. (Although it also exhibits what may be early warning signs of slippage.)

As shown in Table 3, school 2 has had increases in retention in eight of the eleven years of the study. Looking at the retention rates shows clearly that something occurred

or some action was taken in the late nineteen eighties that triggered a dramatic turnaround in this school's ability to retain students.

Comparing Subgroups Within a School

Comparing subgroups within a school sometimes helps to illuminate the patterns that appear in the aggregate data – and sometimes brings out phenomena that are masked by the aggregate data. For example, school 5 is having serious problems with retaining students overall (Table 2 & Figure 2), including new first-year students (Table 4), yet it has the highest rate of internal retention for new transfer students. School 6, which is also experiencing difficulty in retention, also has a low rate of retention of new transfers, but students from this school choose to transfer to other units within the institution (rather than withdraw) at a higher rate.

Table 4
Student Flow Matrix Model: Placement Results for First-time Freshmen

School	1986	1987	1988	1989	1990	1991
School 1	n/a	Decisive	Digressive	Decisive	Digressive	Persisting
School 2	n/a	Digressive	Migrating	Digressive	Sustaining	Persisting
School 3	n/a	Departing	Digressive	Sustaining	Persisting	Digressive
School 4	n/a	Departing	Sustaining	Persisting	Digressive	Migrating
School 5	n/a	Migrating	Decisive	Sustaining	Decisive	Digressive
School 6	n/a	Departing	Persisting	Digressive	Digressive	Migrating

School	1992	1993	1994	1995	1996	1997
School 1	Decisive	Migrating	Digressive	Digressive	Sustaining	Departing
School 2	Attenuating	Departing	Sustaining	Sustaining	Persisting	Decisive
School 3	Decisive	Persisting	Digressive	Digressive	Persisting	Digressive
School 4	Persisting	Migrating	Persisting	Sustaining	Departing	Digressive
School 5	Attenuating	Digressive	Persisting	Migrating	Digressive	Decisive
School 6	Decisive	Sustaining	Departing	Sustaining	Digressive	Persisting

In school 4, however, new transfer students experience their environments differently from the overall population and new first-year students in a more negative

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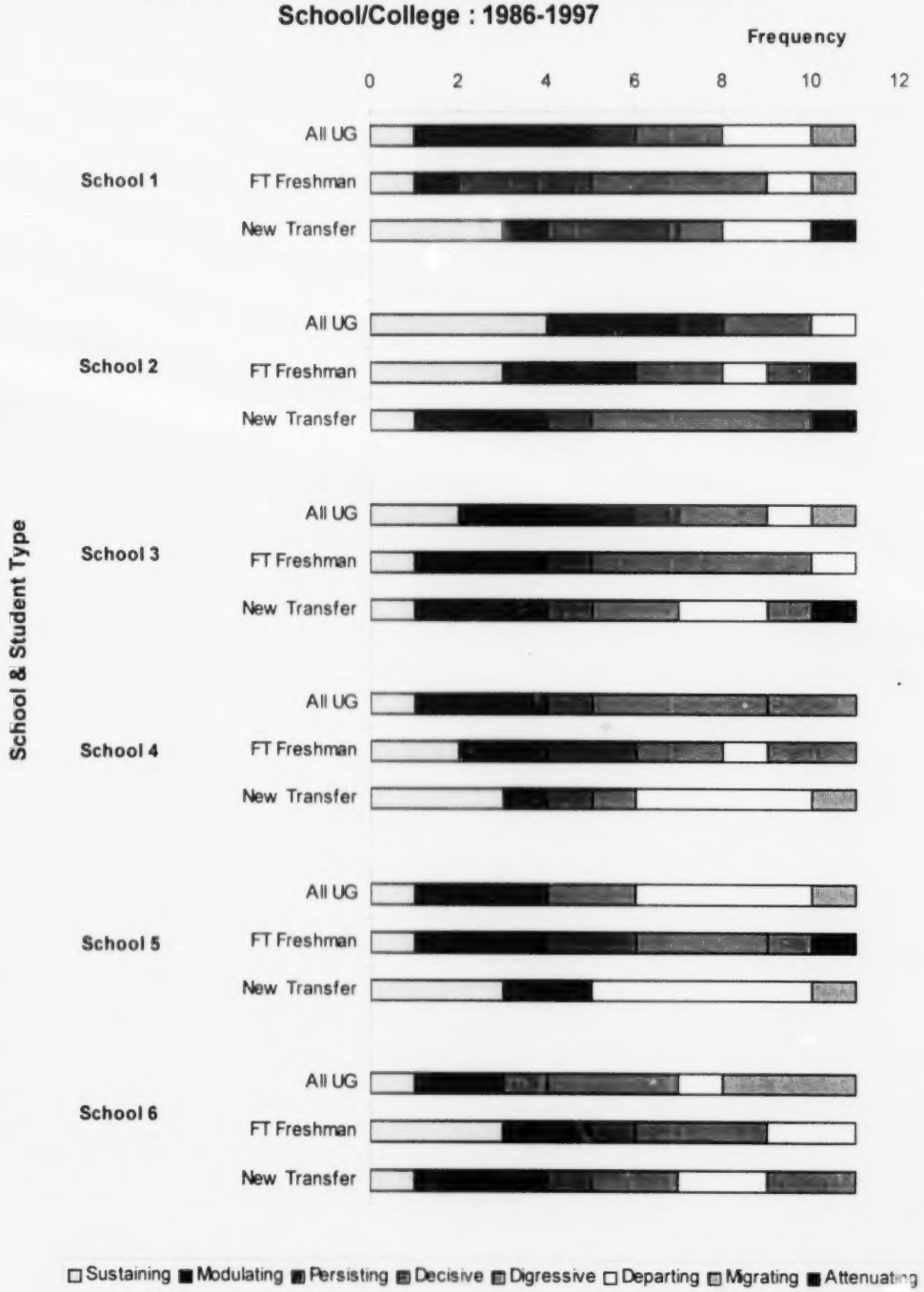
way. The most frequent environment for new transfers is departing as shown in Table 5. So while this school has relatively high retention rates overall, it has the lowest average retention rate for new transfers of all the schools in this university, with both a high external retention rate and the highest rate of withdrawal for new transfers. And school 1 has yet a different pattern, in that it has a relatively low rate of retention of first-year students but a relatively high rate of retention for new transfers.

Table 5
Student Flow Matrix Model: Placement Results for Undergraduate New Transfers

School	1986	1987	1988	1989	1990	1991
School 1	n/a	Decisive	Attenuating	Decisive	Sustaining	Departing
School 2	n/a	Digressive	Attenuating	Persisting	Persisting	Digressive
School 3	n/a	Digressive	Decisive	Persisting	Departing	Sustaining
School 4	n/a	Sustaining	Departing	Sustaining	Departing	Migrating
School 5	n/a	Sustaining	Persisting	Sustaining	Departing	Departing
School 6	n/a	Digressive	Persisting	Persisting	Digressive	Sustaining

School	1992	1993	1994	1995	1996	1997
School 1	Decisive	Sustaining	Digressive	Departing	Persisting	Sustaining
School 2	Decisive	Sustaining	Digressive	Persisting	Digressive	Digressive
School 3	Attenuating	Persisting	Migrating	Departing	Digressive	Persisting
School 4	Decisive	Sustaining	Departing	Digressive	Persisting	Departing
School 5	Departing	Sustaining	Departing	Departing	Migrating	Persisting
School 6	Decisive	Persisting	Departing	Migrating	Departing	Migrating

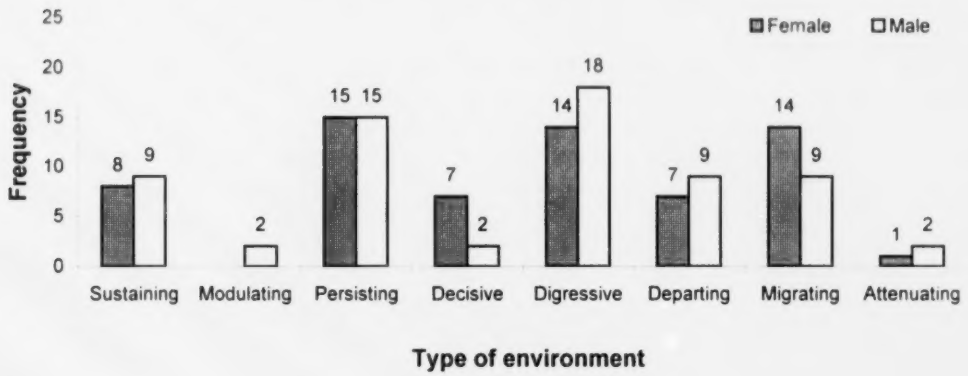
Figure 2.
Comparison of School Environments by Student Type and School/College : 1986-1997



Student Flow Patterns by Gender

To see whether student retention patterns and school environments are constant for male and female undergraduate students, we examined the student flow pattern and school environments by gender. While overall retention patterns measured as internal, external and withdrawal rates over time remained similar between male and female students, school environments were somewhat different between the two groups. As Table 7 shows, the persisting environment occurred most frequently for women students followed closely by digressive and migrating, whereas the digressive was most common for men, followed by persisting. Looking at the actual retention and withdrawal rates shows that women are slightly more likely than men to transfer within the institution.

Figure 3.
Frequencies of School Enviornments
for All Undergraduate Students by Gender: 1986-1997



Again, looking within the units shows that there is wide variance across them in patterns of environments and in what the matrix environments represent. Schools 2 and 3 provide interesting and quite different examples of this variance.

The persisting environment occurs most frequently for women in School 2, followed equally by sustaining and digressing. This school is rebounding from a period

of low retention, and that is reflected in the frequency of environments in which the internal retention rate increases. In fact, this school now has one of the highest retention rates - for women. For males, departing is as common as persisting, followed by decisive, which is consistent with the fact that men withdraw and transfer out at higher rates than do the women in this school. In fact, school 2 is consistently below the university average and has the lowest average retention rate for men of any of the schools.

School 3 is the reverse situation, but to a greater degree. It has the highest average internal retention rate for men and one of the lowest for women. The matrix environments for men are equally divided among sustaining, digressing, departing and migrating. For women, by far the most common is migrating, which points to another interesting trend here. Women who leave school 3 are more likely to transfer to other units than the men.

Background Characteristics and Retention

To investigate how the background characteristics of undergraduate students are associated with the type of retention, the internal and external retention, withdrawal and graduation rates were compared for the subgroups of the key variables determined in the literature review: gender, race, citizenship, student level, student entry type, enrollment status, residency status, and cumulative GPA.[1]

As shown in Table 6, all of the background characteristics were significantly associated with the type of retention, except for gender and citizenship. There was no statistically significant difference in the retention rates between male and female students or between US citizen and foreign students.

[1] Between 1993 and 1997.

Table 6.
Summary of Independent Tests for Relationship between Student Characteristics and Retention Type (1993-1997): All Undergraduates

		Four Retention Types*				
Student Characteristic		1993	1994	1995	1996	1997
Gender	χ^2	3.88	5.07	3.61	24.90	17.67
(Male; Female)	*df*	3	3	3	3	3
	p				**	**
Race	χ^2	79.27	63.81	73.71	63.11	115.20
(White; Black; Others;	*df*	15	15	15	15	15
Foreign)	*p*	**	**	**	**	**
Citizenship	χ^2	5.92	7.84	4.78	5.68	
(US citizen; Foreign)	*df*	3	3	3	3	
	p		*			
Student Level	χ^2	3710.90	3731.00	3643.89	4041.93	3801.77
(Freshman, Sophomore;	*df*	12	12	12	12	12
Junior; Senior;	*p*	**	**	**	**	**
Second Undergraduate)						
Student Entry Type	χ^2	109.29	159.85	204.49	193.45	253.37
	df	18	18	18	18	18
	p	**	**	**	**	**
Enrollment Status	χ^2	310.43	355.98	338.44	299.58	
(Full-time; Part-time)	*df*	3	3	3	3	
	p	**	**	**	**	
Residency Status	χ^2	161.34	114.60	154.85	124.65	152.11
(Commuter; Dorm	*df*	3	3	3	3	3
resident)	*p*	**	**	**	**	**
Cumulative GPA	*F*	281.30	296.81	291.93	358.71	319.24
	df	3, 9879	3, 9985	3, 10149	3, 10290	3, 10557
	p	**	**	**	**	**

Note: ** $p < .01$; * $p < .05$

*The four retention types refer to the internal and external retention, withdrawal and graduation rates.

The findings of this study with regard to the effect of personal factors on college student withdrawal were consistent with those of previous studies. While white and Asian American students were more likely to stay in the same school, black and Hispanic students were more likely to withdraw from the university. Freshmen were more likely to

leave the university. In general, as students moved to upper levels, they were less likely to withdraw from the school. Students who entered the university as first-year students were more likely to return than students who entered as transfers. Of the transfer students, those who entered at the sophomore or junior level were more likely to return while those who entered as freshmen or seniors were more likely to withdraw. Part-time students tended to be considerably less likely to stay in the same school, and to be more likely to withdraw from the university. Interestingly, students who lived in the dorm were more likely to both stay in the same college and to transfer within the institution than commuter students (a sustaining pattern), while commuter students had higher withdrawal rates. Students who withdrew from the university had the lowest cumulative GPA (lower than C: 2.0) among the four groups, however it is not the case that only students with low grades withdrew. Of the students who failed to return the following fall, over 60% had a GPA of at least 2.0.

Conclusion

One purpose of this study was to explore the possibility of linking a retention model with institutional planning. While the matrix model alone has some limitations, use of this approach to modeling retention patterns can provide useful information for university decision-makers. The matrix model, in combination with the retention and withdrawal rates that underlie it, can aid in identifying and describing retention and withdrawal patterns within the institution. As these patterns are analyzed further, they may provide an assessment of whether the university is achieving its goals for student success – and identify factors in the environment or practices that either contribute to - or detract from – the institution's ability to perform effectively. The flow information may additionally be useful in refining the university's enrollment projections.

Secondly, the enhanced model does show how student retention and withdrawal patterns are – and in some cases, are not – associated with characteristics of students,

such as gender, ethnicity, class level, entry type, GPA and major, for students at this institution. Breaking the data out by subgroups helps to focus attention on the interaction between the characteristics and different environments within the university. An interesting finding of this study was that gender did not appear to be associated with retention for the overall population. It was not until the data was disaggregated by academic unit that the effects of gender became apparent.

The final purpose of this study was to interpret and present the findings in a way that would lead to action, thereby completing the link from model to study to planning to action. At this point, the internal report of the study findings is still being compiled, but initial reactions of some key decision-makers is that the report(s) will help them to target retention strategies more effectively, as opposed to using the shot-gun approach to problem solving. Areas where action could be taken range from better communication of specific program requirements to new transfer students to development of programs that target specific environments of some of the sub-groups.

One of the strengths of the matrix model is its ability to represent complex relationships between alternative behaviors simultaneously. A limitation of the model is that the matrix environments are defined exclusively by the direction of change in the internal and external retention rates and the withdrawal rate and do not represent the actual rates in any way. They are most useful in identifying patterns of activity and for comparing those patterns across groups, but as we saw earlier, it would be possible to draw incorrect conclusions based on a review of the environments alone. Also, since it is premised on change, periods of no change do not fit the model.

Another limitation of this study was that it did not distinguish between dropouts and stopouts. Since it is part of this university's core mythology that stopping out and returning are common occurrences among its student population, that would be a important factor to look at as well. This needs to be addressed in another phase of the study. It should also be noted that there may be other factors that could have been taken

into account, such as incoming student test scores, hours worked etc. Finally, since meaningful patterns seem to become more apparent as the data is disaggregated. Further breakdowns by group such as first-year students by gender, or ethnicity by school, might have provided more useable data, however as the "n"s become smaller, the retention rates become more variable, which may result in less meaningful data.

Implications for Institutional Research

Institutional research plays a major role in helping the university to understand the dynamics of its student enrollment flow. In addition to providing information to aid in the development of informed projections about future enrollment, this information also contributes to efforts to improve the student success rate in the institution. Linking this information to university planning involves interpreting and presenting the data in ways that make sense to the audience. An advantage of using a matrix model is that in situations where complex behaviors are to be represented, a matrix model can be used to show the dynamics of the various relationships between them. In the case of retention and attrition, students may stay in the same school, change schools within the same institution, or leave the institution entirely (or graduate). The student retention matrix enables us to look at how these behaviors interact in a given environment over time. However, as indicated above, the model is most informative when the underlying retention and withdrawal rates are factored into the analysis. Reliance on the patterns of the environments alone could lead to incorrect interpretations of the underlying activity.

The model is most useful in comparing subgroups, as when first-year students are compared to all undergraduates or to new transfer students, or when subgroups are compared between schools, e.g. women in business compared to all undergraduate women. Differences between subgroups help focus our attention on questions and issues that may lead to the development of action steps that will address the needs of specific subgroups of the student population.

The initial review of the data suggests that different subgroups of students may have different experiences of the university. The next phase of the study is to further analyze and interpret the data so that those persons who are in a position to impact the environments within the university are able to reach informed conclusions. The next step will be to develop action plans to either reinforce positive aspects of the environment or change those factors which appear to negatively impact student achievement of academic goals. Continuation of the analysis will include:

- Examining the patterns within each school and searching for factors that can help to explain a trend and fluctuations or aberrations in it. Are there similarities across schools? Are there university policies or practices that impact students differently depending on their choice of major and/or the point in time at which they enter? What are the migration patterns of students who move between schools within the institution?

- Identifying similar "environments" for sub-groups of students by gender, ethnicity, type of entry, major etc, in such a way as to isolate the factors that contribute to creating these differential effects. Deciding what data we need to identify these factors. Can we find it in extant data or do we need additional data sources? What specific factors can be targeted for change?

- Identifying historical events that may have influenced a given environment at some time (e.g. enrollment caps on specific majors, changes in degree requirements).

The student retention matrix model provides a context in which to examine many factors affecting student attrition and can be an important tool in the development of a comprehensive enrollment management program. The job of Institutional Research is to select meaningful data and present it in ways that enhance the ability of decision-makers to move from the retention model to planning that results in effective action.

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